is taken the number of accurate significant figures left is much reduced. These things are all simple enough, and are readily seen to be true once attention is drawn to them, but to many they seem to be considerations of a wholly new sort.

2. *Analytical trigonometry.* Somehow the signs of the trigonometric functions in the various quadrants should be taught so as to be retained, also the process of looking up functions of an angle greater than 90°, and the fact that the angle corresponding to a given function is not unique. Furthermore, a working knowledge of various trigonometric transformations is useful in applied mathematics.

3. *Approximations.* It is desirable to give students who are to apply their mathematics some instruction and training in the use of approximate formulas, in order that they may not distrust an admittedly approximate formula in those cases where it legitimately applies, and in order that, on the other hand, they may realize the limitations of such a formula and not try to make it do more than it is able to do.

AMONG MY AUTOGRAPHS.

By DAVID EUGENE SMITH, Columbia University.

12. THE MARQUISE DU CHASTELLET.

One of the letters in my collection is of special interest because of two lines. The letter is as follows:

> We have arrived in good health, Monsieur, but with disquietude which your own health causes us. I hoped that M. Cléraut would have had news from you. I beg of you to give me information about yourself, and to tell me if we shall see you soon. You do not realize the interest that I have. M. de Voltaire charges me to present to you his most affectionate compliments; and as for me, I am, with very profound friendship, Monsieur, your very humble and very obedient servant
>
>   BRETEUIL DU CHASTELLET.
>
> PARIS, August 31, 1744.
>   I hope that you will not forget our little affair.

So Voltaire sends by the Marquise du Chastellet (to adopt her own spelling of the name) his affectionate compliments to some one whom we do not know. She was entirely frank about delivering the message. Voltaire, who six years before this had essayed to make Newton intelligible to the French people, was with her. In 1735 they had begun their work together at the Chastellet country place at Cirey,—"that pitiless bore, the unfortunate Marquis," assenting, and conveniently spending some time with his regiment and in Paris, but accepting without protest the eighteenth-century customs even when at home. In July of the year 1744 they were again at Cirey, Voltaire, as usual, in bed and hard at work. He was fifty and the Marquise was thirty-eight. They went up to Paris the latter part of August, preparing for the festival of rejoicing at Louis XV's recovery from an illness and his return from the wars. There was also Voltaire's *Princess* that was soon to be produced, and this demanded his presence at the capital—a production that brought him much acclaim.

A biographer who, being a woman, may be thought to have understood the Marquise, writes that "at his side was the woman who was the aptest pupil of Maupertuis and almost the only other person in France who understood Newtonianism save Maupertuis himself, Voltaire, and one Clairaut. The rest of the world was Cartesian." This Clairaut is the "M. Cléraut" of the letter, the Alexis-Claude Clairaut, then thirty-one years old, who had just published his *Théorie de la figure de la terre* (Paris, 1743). Five years later, while she was getting help from him in her work on Newton, he excited the jealous rage of Voltaire, who broke open a door at Cirey as a result, and then rushed down the stairs followed by the most notable woman mathematician of France and by one of the best-known men in the same field of work. Voltaire soon had occasion to repent his anger in sackcloth and ashes, for the Marquise died in 1749, at the age of forty-three. One of her Paris acquaintances, a grande dame of the salons, with the heartlessness of the age, remarked that "to die in childbed at her age is to wish to make oneself peculiar: it is to pretend to do nothing like other people." Frederick the Great, who would sacrifice all delicacy of feeling, if he ever had any, for the sake of a *bon mot*, suggested as her epitaph, "Here lies, one who lost her life in giving birth to an unfortunate infant and a treatise on philosophy." Thus came into light du Chastellet's work on Newton, together with a child of uncertain parentage, and thus passed away the most brilliant woman of both a country and a century of women of exceeding brilliancy,— intellectually, socially, and, probably in more cases than society history would lead us believe, morally as well.

13. CASSINI COMPLETES THE GREAT SURVEY OF FRANCE.

The first noteworthy attempt at measuring the earth, made in modern times was that of Jean Fernel, about 1528. He took the arc determined by Paris and Amiens, the two stations being located approximately on the same meridian. Considering the instruments available, his results were remarkable. He found that $1° = 57,099$ toises, while the mean obtained by Lacaille and Delambre in the latter part of the eighteenth century, at which time the instruments were very satisfactory, was 57,068 toises. In 1669 and 1670 Jean Picard carried on an elaborate system of triangulation and found that $1° = 57,060$ toises. This meridian was extended by Jean-Dominique Cassini (Cassini I) in 1701 and his work was continued by his son, Jacques, the results being published in Paris in 1720 and serving to set on foot the elaborate surveys which finally determined the spheroidal shape of the earth. César François Cassini de Thury, the son of Jacques, carried on the work of his father and grandfather, publishing his results in 1740, and in 1744 he announced his plan for extending the work to include the making of a map of France. He was followed by a representative of the fourth generation of the remarkable Cassini family, Jacques-Dominique, who continued the surveys for the map. In 1793 the work appeared in 180 sheets, but there still remained much to be done, and it was not until June 19, 1803, that the last of the four Cassinis was able to report to the authorities that the

great work, which may be said to have begun indirectly in 1528, and directly
in 1744, was at last finished.   The letter announcing this fact is in my collection
and reads as follows:

To General Sanson, Director of the Depôt of War:
    Count Cassini, Member of the Institute, of the General Council, and of the Electoral College
of the Department of the Loire:
    General, I venture to flatter myself that, under the direction of a brave and loyal soldier like
yourself, I can see, at the General Depôt of War, the end of the interminable affair of the Carte
Générale de la France.
    You have before you or your representative the latest decree of the Council of State that
governs the acts of those engaged upon the map of France.   I have examined carefully the report
which they have made, covering the two years under the Minister of War, and I am returning
it with the recommendation that a general settlement be made in accordance therewith.
    This report strengthens still more the agreements between the minister and those who have
acted for the Compagnie de la Carte Générale de la France, concerning the distribution of the
maps to the subscribers and to the associates.
    The decree places the matter hereafter in your hands.   It is for the Depôt of War to cancel
the various obligations, and now it becomes the real owner of the material which has been prepared
under the act relating thereto. . . .
    I cannot retire from the work without taking the opportunity of assuming the honor of
offering to you the testimony of the distinguished consideration which you have inspired within
me and which I shall retain as long as I live.
    General,
                                    Your very humble
                                        CASSINI
                                            Member of the Institute.
    1st Messidor, an XI (June 19, 1803).

The letter bears the usual memoranda of reference for report, and of filing.
The omitted portion has no special interest, referring only to details of dis-
tribution.

Thus ended a great scientific work that had extended over so many years,—
the greatest work of its kind that had ever been undertaken up to that time, now
more than a century ago.

QUESTIONS AND DISCUSSIONS.

EDITED BY W. A. HURWITZ, Cornell University, Ithaca, N. Y.

DISCUSSIONS.

The first discussion was suggested by Problem 2863 [*1920*, 482];[1] it appears
in this department because the method of attack and the incidental results
give it an independent interest.   Mr. T. L. Bennett discusses certain properties
of roulette curves by the method of circular coördinates.   He has presented the
material in such form as to imply no previous acquaintance with this method;
and indeed his discussion gives an adequate introduction to the study of the
properties of circular coördinates.[2]

[1] See the problem department of this issue of the MONTHLY.

[2] The idea of circular coördinates seems to have originated with Plücker. Some articles
dealing with the subject are: "Ueber Kreiscoordinaten" by W. Stämmer, *Journal für die reine
und angewandte Mathematik*, vol. 44, 1852, pp. 295–316; "On some applications of circular co-
ordinates" by F. Franklin, *American Journal of Mathematics*, vol. 12, 1890, pp. 161–190; "Sundry
metric theorems concerning n lines in a plane" by F. H. Loud, *Transactions of the American Mathe-
matical Society*, vol. 1, 1900, pp. 323–338; and F. Morley's article, pp. 97–115, referred to below.
—EDITOR.